WHAT IS CLAIMED IS:

1   1.   A method for managing files in a file system, comprising:

2   receiving data for a file;

3   storing the data for the file in a plurality of segments;

4   generating an index associated with the file indicating how the file data maps to

5 the segments;

6   receiving an Input/Output request with respect to an address in the file;

7   using the index for the file to determine the segment including data at the

8 requested address in the file; and

9   accessing the determined segment including the data at the requested address.

1   2.   The method of claim 1, wherein data is stored in the segments by:

2   writing the received file data to one segment; and

3   writing further received data for the file to subsequent segments if the last

4 segment to which the received data was written has no more available space.

1   3.   The method of claim 1, wherein each segment has a fixed byte length,

2 wherein the index provides a segment order indicating an order in which file data is

3 written to the segments, and wherein the index for the file is used to determine the

4 segment including data at the requested address in the file by:

5   determining an offset into the file including the data at the requested address; and

6   determining an integer quotient value resulting from the offset into the file divided

7 by the fixed byte length, wherein the segment including the data at the requested address

8 is the segment at the integer quotient value in the segment order.

1   4.   The method of claim 3, further comprising:

2   receiving user input indicating the fixed byte length of each segment.

1   5.   The method of claim 1, further comprising:

2   providing a segment size that is at least greater than a byte size of a largest section

3 within the file; and

4   writing each file section to one segment.

1   6.   The method of claim 1, further comprising:

2   storing the segments in a primary storage;

3   copying at least one of the segments in the primary storage onto a secondary

4 storage; and

5   releasing at least one of the segments copied to the secondary storage, wherein

6 space used by the released segment in the primary storage is available for use.

1   7.   The method of claim 6, wherein as a result of releasing one or more

2 segments, different segments for one file are capable of being stored in the primary

3 storage and the secondary storage.

1   8.   The method of claim 6, wherein accessing the determined segment

2 including the requested address further comprises:

3   determining whether the determined segment is available in the primary storage;

4 and

5   copying the determined segment from the secondary storage to the primary storage

6 if the determined segment is not available in the primary storage.

1   9.   The method of claim 6, wherein releasing the segment comprises:

2   storing a partial version of the released segment including less than all data in the

3 segment, wherein the segment data not in the partial version is stored in the secondary

4 storage, wherein the partial version remains on the primary storage after the segment is

5 released.

1 10. The method of claim 9, wherein the partial version of the determined

2 segment is on the primary storage and wherein accessing the determined segment

3 including the requested address further comprises:

4 accessing the partial version of the determined segment on the primary storage to

5 access the data therein;

6 reaching the end of the partial version when accessing data therein;

7 staging from the secondary storage to the primary storage data from the

8 determined segment that is not in the partial version; and

9 accessing the data from the determined segment staged from the secondary storage

10 to the primary storage.

1 11. The method of claim 9, wherein the partial version is stored only for a

2 first segment of the segments associated with the file.

1 12. The method of claim 6, further comprising:

2 accessing data at the end of the segment, wherein the I/O request requires further

3 file data after accessing the end of the segment;

4 determining from the index a next segment including file data following the file

5 data at the end of the segment data; and

6 accessing the next segment in the primary storage to access the further required

7 file data.

1 13. The method of claim 6, further comprising:

2 maintaining metadata for each segment that is also maintained for files in the file

3 system; and

4 using the metadata for segments and files to determine when to copy segments

5 and files to the secondary storage and when to release segments and files in the primary

6 storage.

1   14.   The method of claim 13, wherein segments and files in the primary storage

2   are released according to their metadata if used space in the primary storage reaches a

3   threshold level.

1   15.   The method of claim 6, wherein the file data in all the segments for the file

2   is capable of being larger than a storage capacity of the primary storage.

1   16.   The method of claim 6, further comprising:

2   reading data from one target segment on the secondary storage;

3   determining whether a stage attribute is specified indicating a number of segments

4   to stage ahead; and

5   initiating read requests to stage the number of subsequent segments following the

6   target segment from the secondary storage to the primary storage.

1   17.   The method of claim 16, further comprising:

2   receiving user input indicating the number of segments to stage ahead.

1   18.   The method of claim 1, wherein the segment does not have a file name and

2   is not represented as a file in the file system.

1   19.   The method of claim 1, wherein the index is stored in the file, wherein no

2   user data is stored in the file and all the user data is distributed in the segments.

1   20.   A method for managing files in a primary and secondary storage, wherein

2   the secondary storage is comprised of a plurality of drives and storage devices capable of

3   being mounted on the drives, comprising:

4   receiving data for a file;

5   storing the data for the file in a plurality of segments;

6   generating an index associated with the file indicating how file data maps to

7 segments; and

8   writing each segment to one of the drives, wherein segments are written to

9 multiple of the drives to distribute the segments across multiple storage devices.

1   21.   The method of claim 20, wherein multiple segments are written in parallel

2 to multiple storage devices in multiple drives.

1   22.   The method of claim 20, further comprising

2   reading segments on multiple storage devices from multiple drives to stage

3 multiple segments in parallel into the primary storage.

1   23.   The method of claim 20, wherein the drives comprise tape drives and

2 wherein the storage devices comprise tape cartridges.

1   24.   A system for managing files, comprising:

2   a computer readable medium;

3   a storage system;

4   means for receiving data for a file;

5   means for storing the data for the file in a plurality of segments in the storage

6 device;

7   means for generating an index in the computer readable medium associated with

8 the file indicating how the file data maps to the segments;

9   means for receiving an Input/Output request with respect to an address in the file;

10   means for using the index for the file to determine the segment including data at

11 the requested address in the file; and

12   means for accessing the determined segment including the data at the requested

13 address.

1   25.   The system of claim 24, wherein the means for storing the for the file in

2   the segments performs:

3   writing the received file data to one segment; and

4   writing further received data for the file to subsequent segments if the last

5   segment to which the received data was written has no more available space.

1   26.   The system of claim 24, wherein each segment has a fixed byte length,

2   wherein the index provides a segment order indicating an order in which file data is

3   written to the segments, and wherein means for using the index for the file to determine

4   the segment including data at the requested address in the file performs:

5   determining an offset into the file including the data at the requested address; and

6   determining an integer quotient value resulting from the offset into the file divided

7   by the fixed byte length, wherein the segment including the data at the requested address

8   is the segment at the integer quotient value in the segment order.

1   27.   The system of claim 26, further comprising:

2   means for receiving user input indicating the fixed byte length of each segment.

1   28.   The system of claim 24, further comprising:

2   means for providing a segment size that is at least greater than a byte size of a

3   largest section within the file; and

4   means for writing each file section to one segment.

1   29.   The system of claim 24, wherein the storage system comprises a primary

2   storage, further comprising:

3   a secondary storage;

4   means for copying at least one of the segments in the primary storage onto the

5   secondary storage; and

6   means for releasing at least one of the segments copied to the secondary storage,

7   wherein space used by the released segment in the primary storage is available for use.

1   30.   The system of claim 29, wherein as a result of releasing one or more

2   segments, different segments for one file are capable of being stored in the primary

3   storage and the secondary storage.

1   31.   The system of claim 29, wherein the means for accessing the determined

2   segment including the requested address further performs:

3   determining whether the determined segment is available in the primary storage;

4   and

5   copying the determined segment from the secondary storage to the primary storage

6   if the determined segment is not available in the primary storage.

1   32.   The system of claim 29, wherein the means for releasing the segment

2   performs:

3   storing a partial version of the released segment including less than all data in the

4   segment, wherein the segment data not in the partial version is stored in the secondary

5   storage, wherein the partial version remains on the primary storage after the segment is

6   released.

1   33.   The system of claim 32, wherein the partial version of the determined

2   segment is on the primary storage and wherein the means for accessing the determined

3   segment including the requested address further performs:

4   accessing the partial version of the determined segment on the primary storage to

5   access the data therein;

6   reaching the end of the partial version when accessing data therein;

7   staging from the secondary storage to the primary storage data from the

8   determined segment that is not in the partial version; and

9   accessing the data from the determined segment staged from the secondary storage

10   to the primary storage.

1   34.   The system of claim 32, wherein the partial version is stored only for a

2   first segment of the segments associated with the file.

1   35.   The system of claim 29, further comprising:

2   means for accessing data at the end of the segment, wherein the I/O request

3   requires further file data after accessing the end of the segment;

4   means for determining from the index a next segment including file data

5   following the file data at the end of the segment data; and

6   means for accessing the next segment in the primary storage to access the further

7   required file data.

1   36.   The system of claim 29, further comprising:

2   means for maintaining metadata for each segment that is also maintained for files

3   in the file system; and

4   means for using the metadata for segments and files to determine when to copy

5   segments and files to the secondary storage and when to release segments and files in the

6   primary storage.

1   37.   The system of claim 24, wherein segments and files in the primary storage

2   are released according to their metadata if used space in the primary storage reaches a

3   threshold level.

1   38.   The system of claim 29, wherein the file data in all the segments for the

2 file is capable of being larger than a storage capacity of the primary storage.

1   39.   The system of claim 29, further comprising:

2   means for reading data from one target segment on the secondary storage;

3   means for determining whether a stage attribute is specified indicating a number

4 of segments to stage ahead; and

5   means for initiating read requests to stage the number of subsequent segments

6 following the target segment from the secondary storage to the primary storage.

1   40.   The system of claim 39, further comprising:

2   means for receiving user input indicating the number of segments to stage ahead.

1   41.   The system of claim 24, wherein the segment does not have a file name

2 and is not represented as a file in the file system.

1   42.   The system of claim 24, wherein the index is stored in the file, wherein no

2 user data is stored in the file and all the user data is distributed in the segments.

1   43.   A system method for managing files, comprising:

2   a primary storage;

3   a secondary storage comprised of a plurality of drives and storage devices capable

4 of being mounted on the drives;

5   means for receiving data for a file;

6   means for storing the data for the file in a plurality of segments on the primary

7 storage;

8   means for generating an index associated with the file indicating how file data
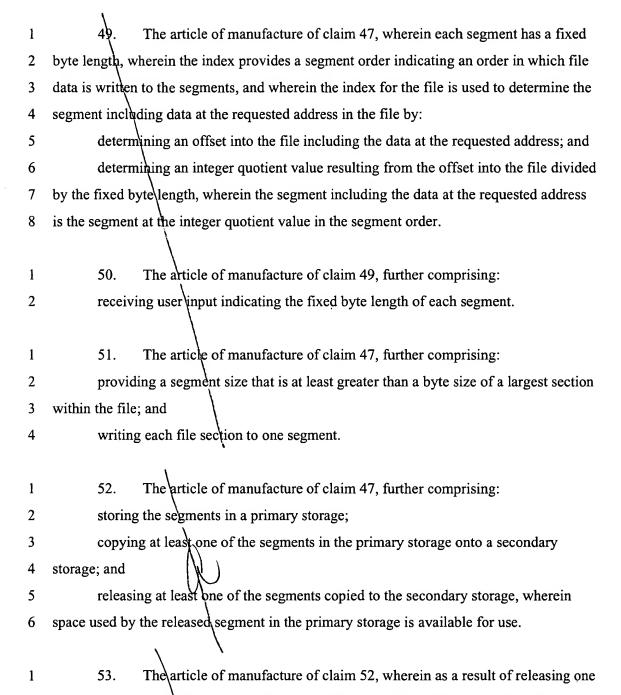
9 maps to segments; and

10   means for writing each segment to one of the drives, wherein segments are written

11   to multiple of the drives to distribute the segments across multiple storage devices.

1   44.   The system of claim 43, wherein multiple segments are written in parallel

2   to multiple storage devices in multiple drives.

1   45.   The system of claim 43, further comprising

2   means for reading segments on multiple storage devices from multiple drives to

3   stage multiple segments in parallel into the primary storage.

1   46.   The system of claim 43, wherein the drives comprise tape drives and

2   wherein the storage devices comprise tape cartridges.

1   47.   An article of manufacture for managing files in a file system, comprising:

2   receiving data for a file;

3   storing the data for the file in a plurality of segments;

4   generating an index associated with the file indicating how the file data maps to

5   the segments;

6   receiving an Input/Output request with respect to an address in the file;

7   using the index for the file to determine the segment including data at the

8   requested address in the file; and

9   accessing the determined segment including the data at the requested address.

1   48.   The article of manufacture of claim 47, wherein data is stored in the

2   segments by:

3   writing the received file data to one segment; and

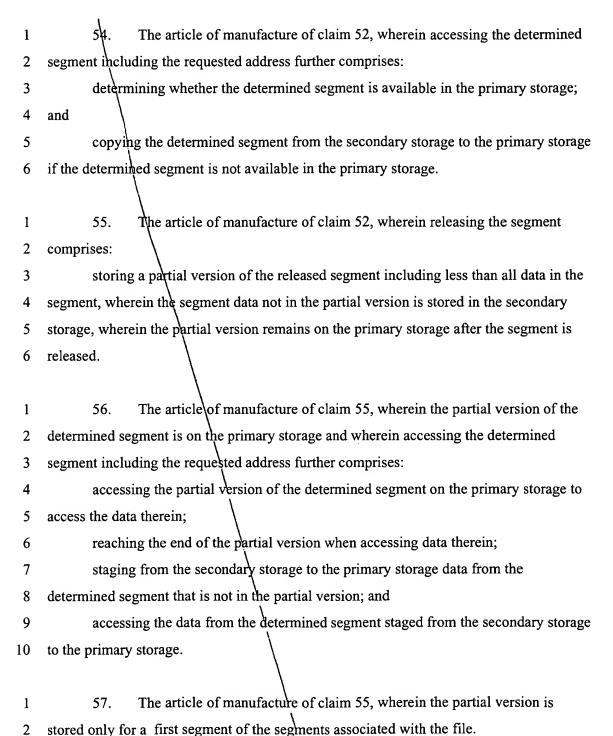4   writing further received data for the file to subsequent segments if the last

5   segment to which the received data was written has no more available space.

1   49.   The article of manufacture of claim 47, wherein each segment has a fixed

2   byte length, wherein the index provides a segment order indicating an order in which file

3   data is written to the segments, and wherein the index for the file is used to determine the

4   segment including data at the requested address in the file by:

5   determining an offset into the file including the data at the requested address; and

6   determining an integer quotient value resulting from the offset into the file divided

7   by the fixed byte length, wherein the segment including the data at the requested address

8   is the segment at the integer quotient value in the segment order.

1   50.   The article of manufacture of claim 49, further comprising:

2   receiving user input indicating the fixed byte length of each segment.

1   51.   The article of manufacture of claim 47, further comprising:

2   providing a segment size that is at least greater than a byte size of a largest section

3   within the file; and

4   writing each file section to one segment.

1   52.   The article of manufacture of claim 47, further comprising:

2   storing the segments in a primary storage;

3   copying at least one of the segments in the primary storage onto a secondary

4   storage; and

5   releasing at least one of the segments copied to the secondary storage, wherein

6   space used by the released segment in the primary storage is available for use.

1   53.   The article of manufacture of claim 52, wherein as a result of releasing one

2   or more segments, different segments for one file are capable of being stored in the

3   primary storage and the secondary storage.

1   54.   The article of manufacture of claim 52, wherein accessing the determined

2   segment including the requested address further comprises:

3   determining whether the determined segment is available in the primary storage;

4   and

5   copying the determined segment from the secondary storage to the primary storage

6   if the determined segment is not available in the primary storage.

1   55.   The article of manufacture of claim 52, wherein releasing the segment

2   comprises:

3   storing a partial version of the released segment including less than all data in the

4   segment, wherein the segment data not in the partial version is stored in the secondary

5   storage, wherein the partial version remains on the primary storage after the segment is

6   released.

1   56.   The article of manufacture of claim 55, wherein the partial version of the

2   determined segment is on the primary storage and wherein accessing the determined

3   segment including the requested address further comprises:

4   accessing the partial version of the determined segment on the primary storage to

5   access the data therein;

6   reaching the end of the partial version when accessing data therein;

7   staging from the secondary storage to the primary storage data from the

8   determined segment that is not in the partial version; and

9   accessing the data from the determined segment staged from the secondary storage

10   to the primary storage.

1   57.   The article of manufacture of claim 55, wherein the partial version is

2   stored only for a first segment of the segments associated with the file.

1   58.   The article of manufacture of claim 52, further comprising:

2   accessing data at the end of the segment, wherein the I/O request requires further

3   file data after accessing the end of the segment;

4   determining from the index a next segment including file data following the file

5   data at the end of the segment data; and

6   accessing the next segment in the primary storage to access the further required

7   file data.

1   59.   The article of manufacture of claim 52, further comprising:

2   maintaining metadata for each segment that is also maintained for files in the file

3   system; and

4   using the metadata for segments and files to determine when to copy segments

5   and files to the secondary storage and when to release segments and files in the primary

6   storage.

1   60.   The article of manufacture of claim 59, wherein segments and files in the

2   primary storage are released according to their metadata if used space in the primary

3   storage reaches a threshold level.

1   61.   The article of manufacture of claim 52, wherein the file data in all the

2   segments for the file is capable of being larger than a storage capacity of the primary

3   storage.

1   62.   The article of manufacture of claim 52, further comprising:

2   reading data from one target segment on the secondary storage;

3   determining whether a stage attribute is specified indicating a number of segments

4   to stage ahead; and

5   initiating read requests to stage the number of subsequent segments following the

6   target segment from the secondary storage to the primary storage.

1   63.   The article of manufacture of claim 62, further comprising:

2   receiving user input indicating the number of segments to stage ahead.

1   64.   The article of manufacture of claim 47, wherein the segment does not have

2   a file name and is not represented as a file in the file system.

1   65.   The article of manufacture of claim 47, wherein the index is stored in the

2   file, wherein no user data is stored in the file and all the user data is distributed in the

3   segments.

1   66.   An article of manufacture for managing files in a primary and secondary

2   storage, wherein the secondary storage is comprised of a plurality of drives and storage

3   devices capable of being mounted on the drives, by:

4   receiving data for a file;

5   storing the data for the file in a plurality of segments;

6   generating an index associated with the file indicating how file data maps to

7   segments; and

8   writing each segment to one of the drives, wherein segments are written to

9   multiple of the drives to distribute the segments across multiple storage devices.

1   67.   The article of manufacture of claim 66, wherein multiple segments are

2   written in parallel to multiple storage devices in multiple drives.

1   68.   The article of manufacture of claim 66, further comprising

2   reading segments on multiple storage devices from multiple drives to stage

3   multiple segments in parallel into the primary storage.

1   69.   The article of manufacture of claim 66, wherein the drives comprise tape

2   drives and wherein the storage devices comprise tape cartridges.